

University of Bahrain
College of Information technology
Department of Computer Engineering

Test (2)

Student Name	
I.D. No.	
Section	

Course Title: Digital Logic
Course number: ITCE 202/250
Semester: 1
Academic Year: 2012/2013
Duration : 1 hour
Date: 14th May 2013

Solutions

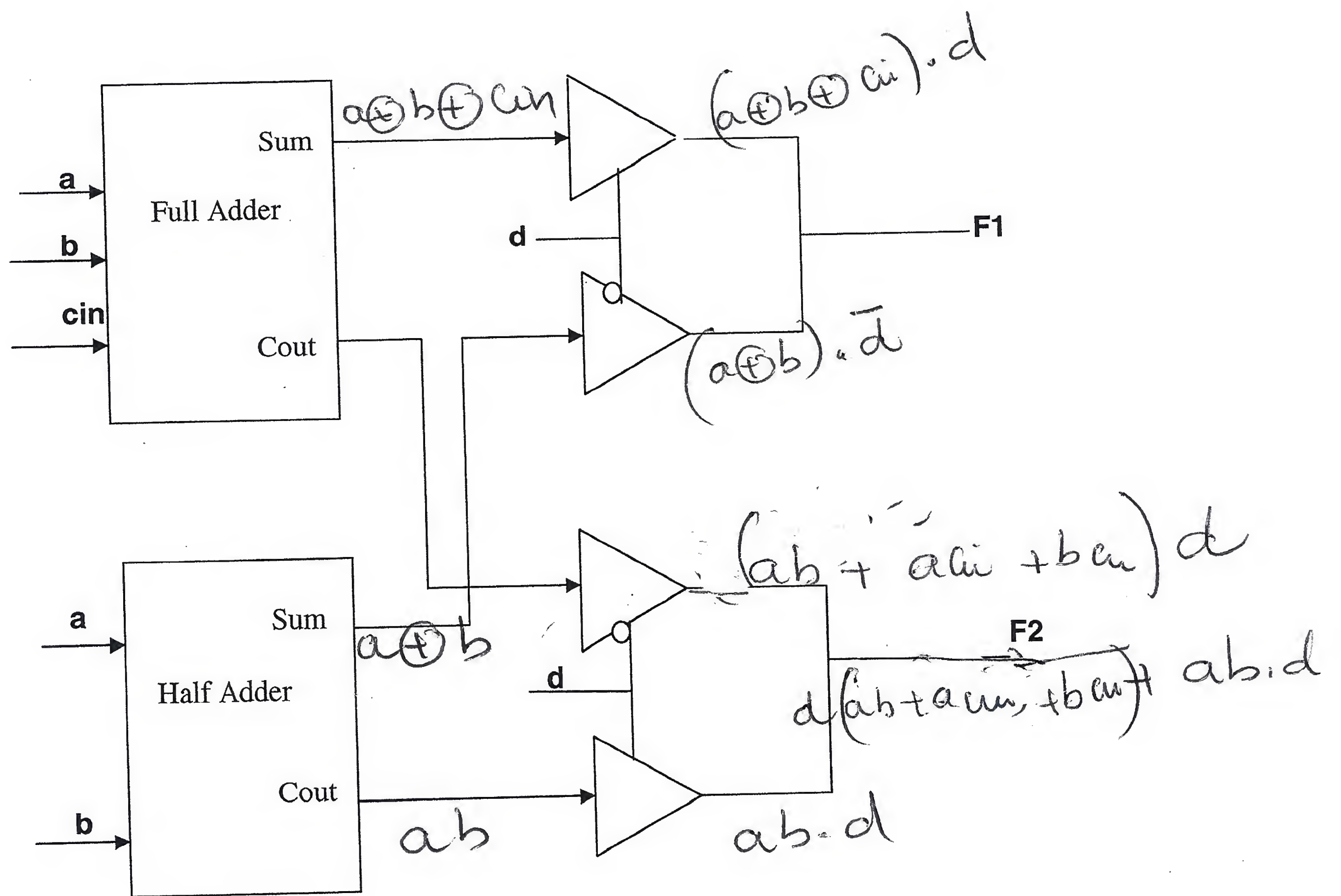
Read the following before you start:

1. Write your name, ID and section number
2. Answer all questions.
3. Write your answers on the attached sheets only.

Question	Mark	Mark attained
1	12	
2	12	
3	12	
4	12	
5	12	
Total	60	

Question [1]: [12 mark]

Write the equations of the functions F1 and F2 generated by the following circuit.

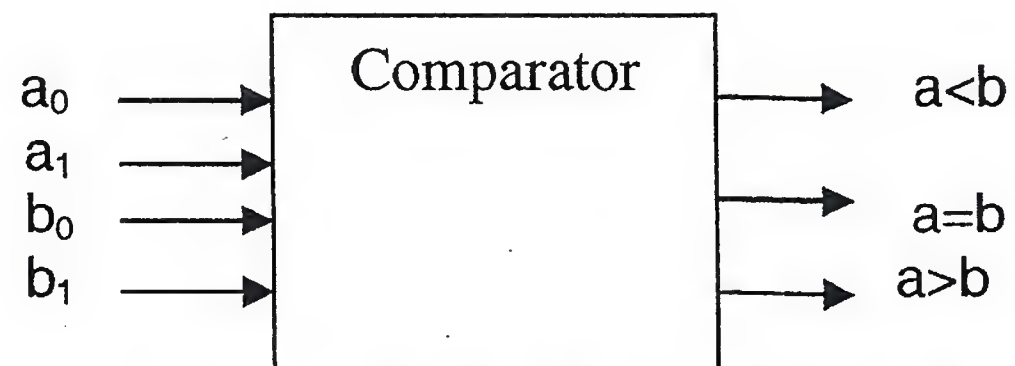


$$F_1 = (a \oplus b \oplus cin) \cdot d + (a \oplus b) \cdot \bar{d}$$

$$F_2 = (ab + acin + bcin) \cdot d + ab \cdot d$$

Question [2] : [12 marks]

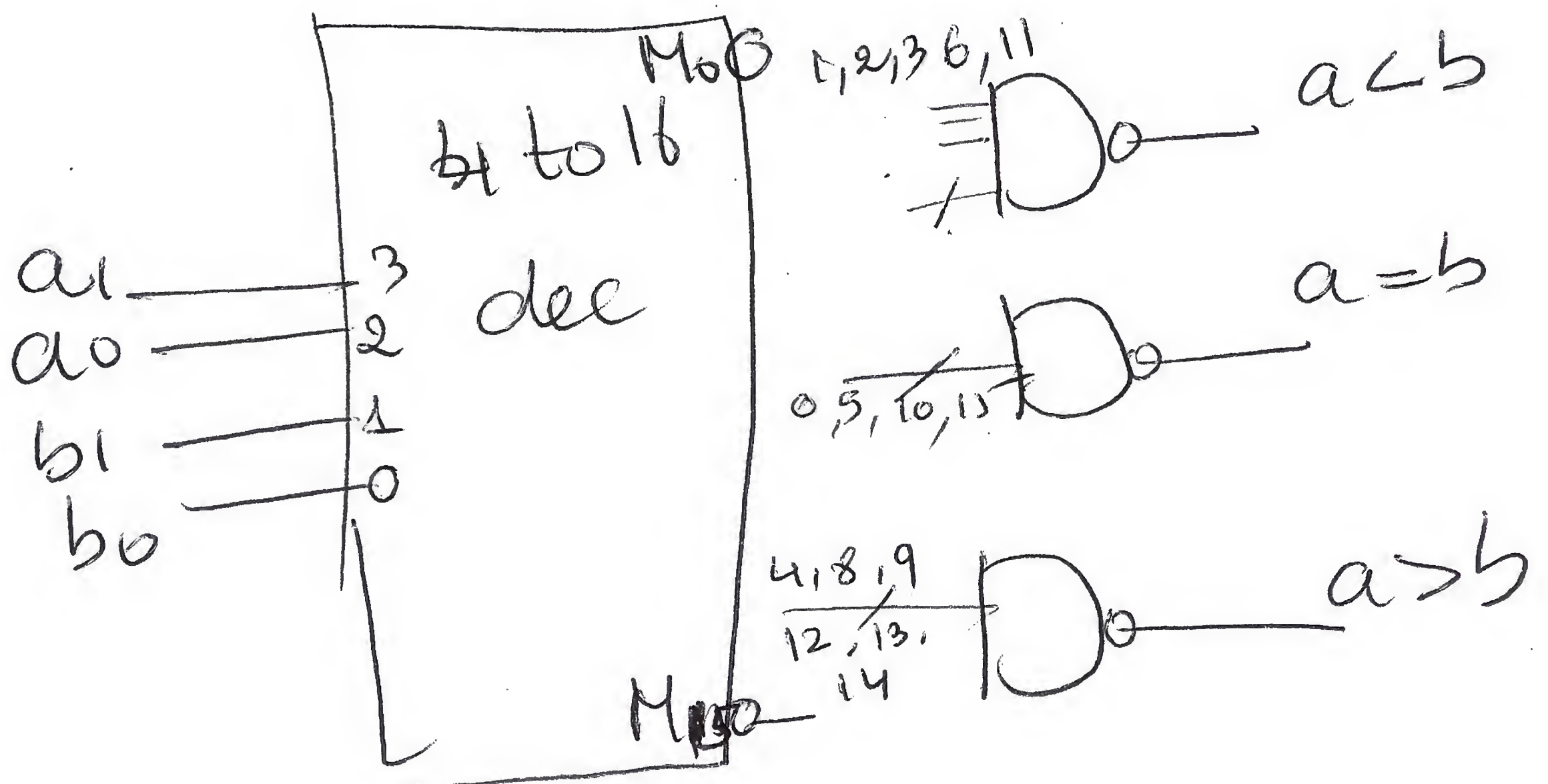
We want to design a 2-bit word comparator that compares the word $a = a_0 a_1$ with the word $b = b_0 b_1$.



1) Give the truth table of the comparator.

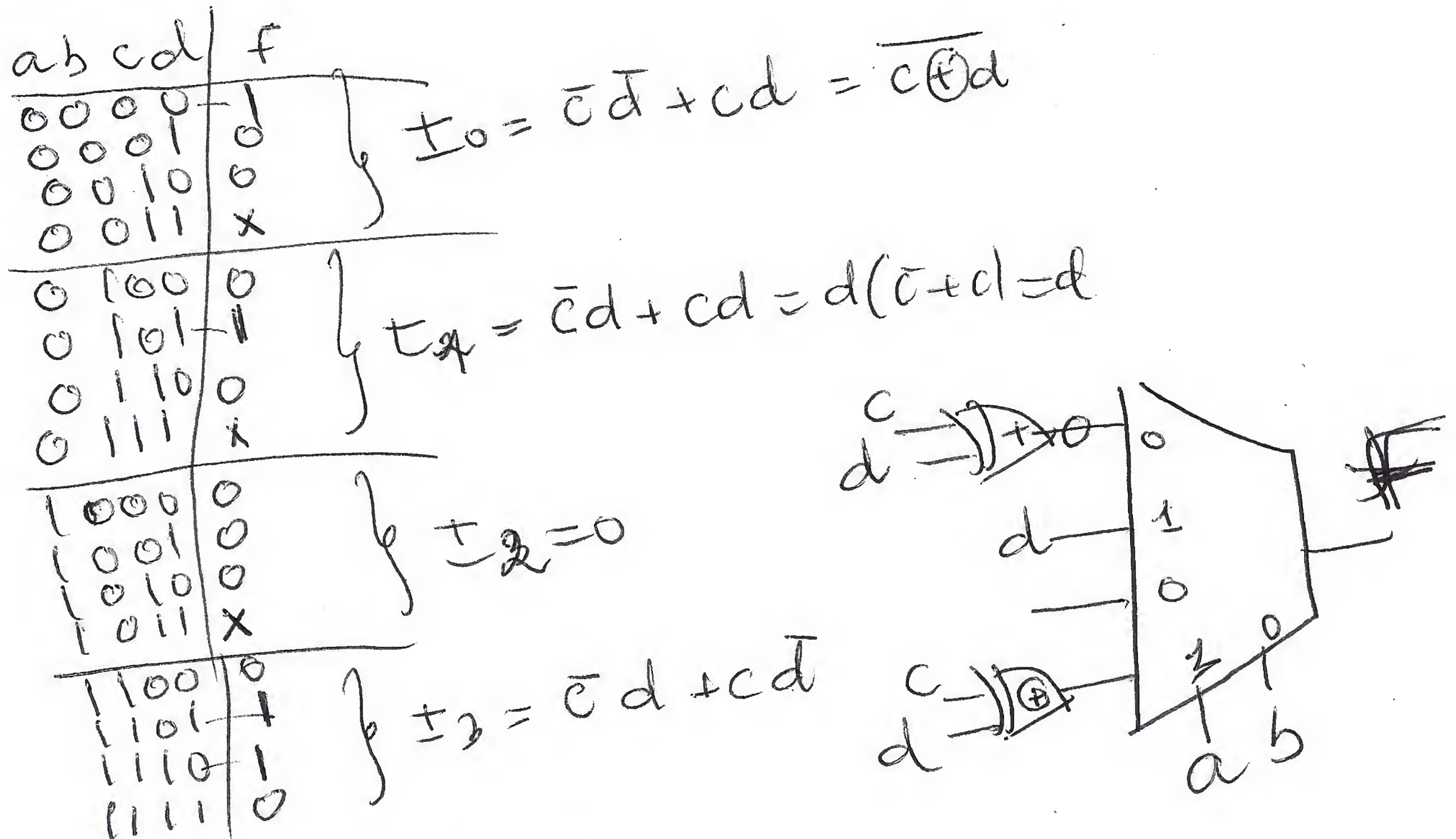
$a_1 a_0$	$b_1 b_0$	$a < b$	$a = b$	$a > b$
00	00	0	1	0
00	01	0	0	0
00	10	0	0	0
00	11	0	0	0
01	00	0	0	0
01	01	0	1	0
01	10	0	0	0
01	11	0	0	0
10	00	0	0	0
10	01	0	0	0
10	10	1	0	0
10	11	0	0	0
11	00	0	0	0
11	01	0	0	0
11	10	0	0	0
11	11	0	1	0

2) Implement the comparator with a decoder with inverted outputs and only NAND gates.

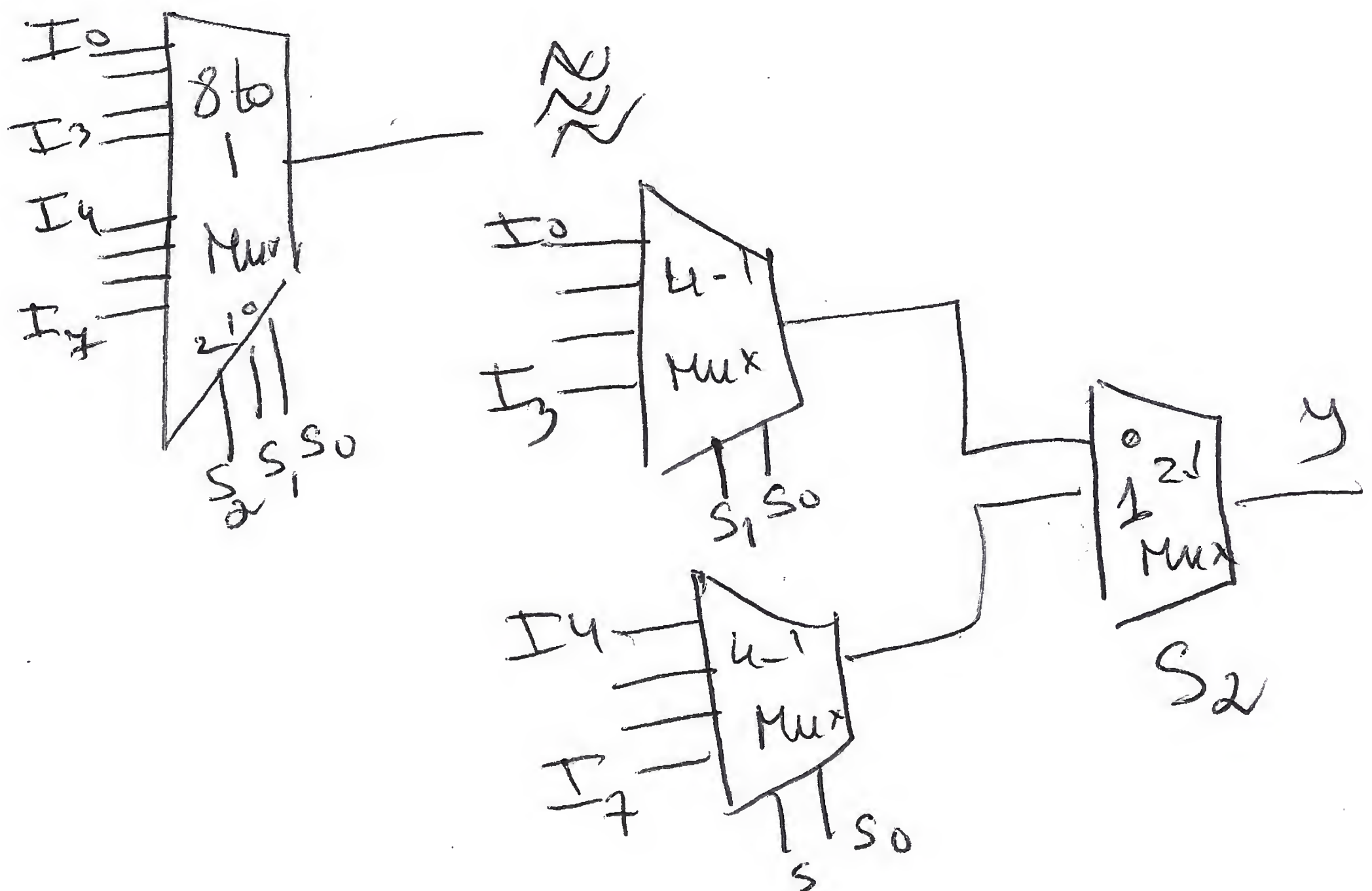


Question [3]: [12 marks]

- a. Implement $F = \sum m(0,5,13,14) + \sum d(3,7,11)$ with a 4 to 1 Multiplexer and a minimum number of gates.



- b- Show how to make an 8 to 1 Mux by using a number of 4-to-1 Muxs and one 2-to-1 Mux.



Question [4]: [12 mark]

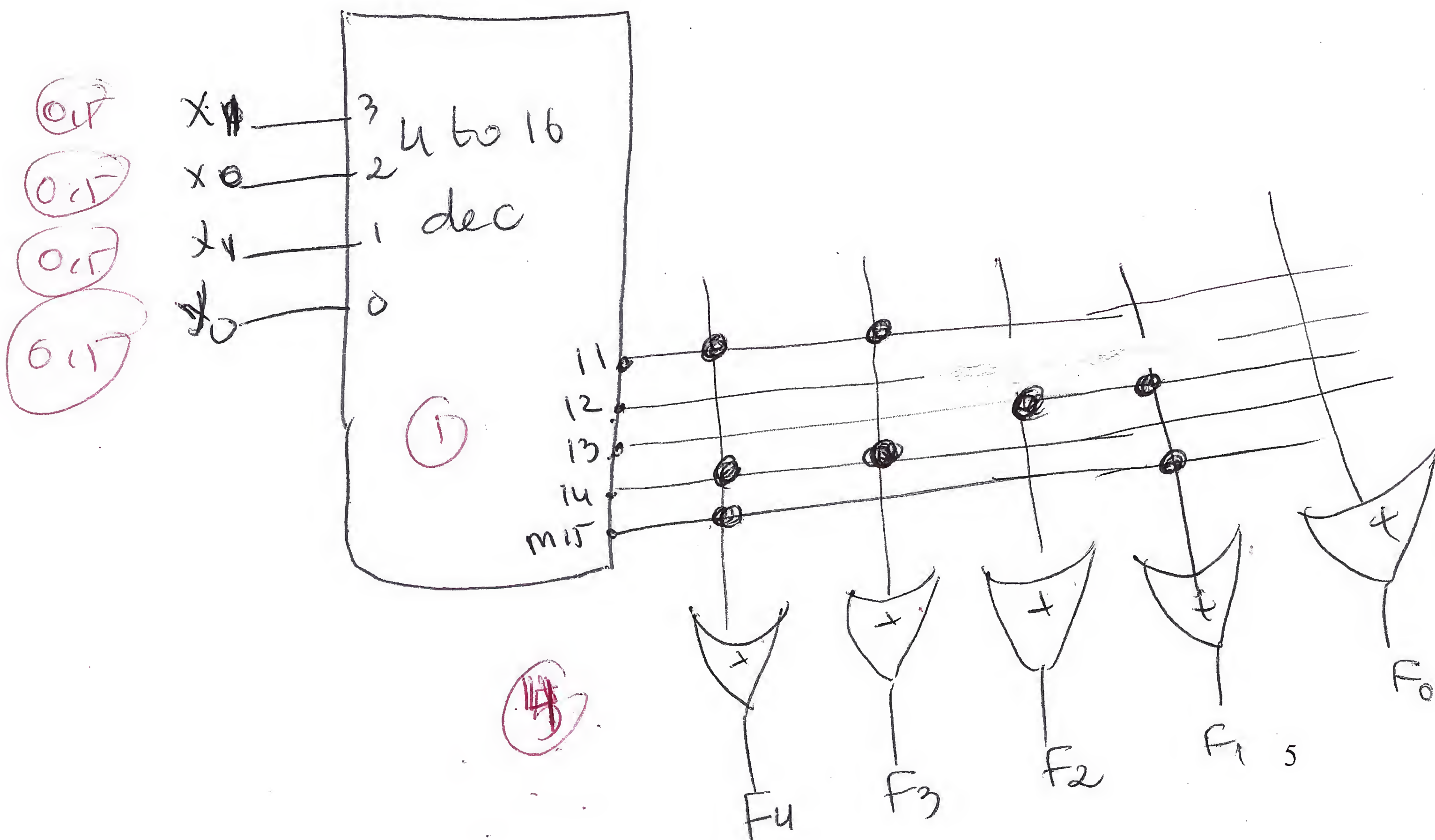
a. Construct the truth table of a ROM to implement the function $F = 2 \times Y$. Where X and Y are 2-bit binary numbers.

$X, X_1 X_0$		$Y, Y_1 Y_0$		F				
				F_4	F_3	F_2	F_1	F_0
00	00	00	00	00	00	00	00	00
00	00	00	01	00	00	00	00	00
00	00	00	10	00	00	00	00	00
00	00	00	11	00	00	00	00	00
00	01	00	00	00	00	00	00	00
00	01	00	01	00	00	00	00	00
00	01	00	10	00	00	00	00	00
00	01	00	11	00	00	00	00	00
00	10	00	00	00	00	00	00	00
00	10	00	01	00	00	00	00	00
00	10	00	10	00	00	00	00	00
00	10	00	11	00	00	00	00	00
00	11	00	00	00	00	00	00	00
00	11	00	01	00	00	00	00	00
00	11	00	10	00	00	00	00	00
00	11	00	11	00	00	00	00	00
01	00	00	00	00	00	00	00	00
01	00	00	01	00	00	00	00	00
01	00	00	10	00	00	00	00	00
01	00	00	11	00	00	00	00	00
01	01	00	00	00	00	00	00	00
01	01	00	01	00	00	00	00	00
01	01	00	10	00	00	00	00	00
01	01	00	11	00	00	00	00	00
01	10	00	00	00	00	00	00	00
01	10	00	01	00	00	00	00	00
01	10	00	10	00	00	00	00	00
01	10	00	11	00	00	00	00	00
01	11	00	00	00	00	00	00	00
01	11	00	01	00	00	00	00	00
01	11	00	10	00	00	00	00	00
01	11	00	11	00	00	00	00	00
10	00	00	00	00	00	00	00	00
10	00	00	01	00	00	00	00	00
10	00	00	10	00	00	00	00	00
10	00	00	11	00	00	00	00	00
10	01	00	00	00	00	00	00	00
10	01	00	01	00	00	00	00	00
10	01	00	10	00	00	00	00	00
10	01	00	11	00	00	00	00	00
10	10	00	00	00	00	00	00	00
10	10	00	01	00	00	00	00	00
10	10	00	10	00	00	00	00	00
10	10	00	11	00	00	00	00	00
10	11	00	00	00	00	00	00	00
10	11	00	01	00	00	00	00	00
10	11	00	10	00	00	00	00	00
10	11	00	11	00	00	00	00	00
11	00	00	00	00	00	00	00	00
11	00	00	01	00	00	00	00	00
11	00	00	10	00	00	00	00	00
11	00	00	11	00	00	00	00	00
11	01	00	00	00	00	00	00	00
11	01	00	01	00	00	00	00	00
11	01	00	10	00	00	00	00	00
11	01	00	11	00	00	00	00	00
11	10	00	00	00	00	00	00	00
11	10	00	01	00	00	00	00	00
11	10	00	10	00	00	00	00	00
11	10	00	11	00	00	00	00	00
11	11	00	00	00	00	00	00	00
11	11	00	01	00	00	00	00	00
11	11	00	10	00	00	00	00	00
11	11	00	11	00	00	00	00	00
11	11	01	00	00	00	00	00	00
11	11	01	01	00	00	00	00	00
11	11	01	10	00	00	00	00	00
11	11	01	11	00	00	00	00	00
11	11	10	00	00	00	00	00	00
11	11	10	01	00	00	00	00	00
11	11	10	10	00	00	00	00	00
11	11	10	11	00	00	00	00	00
11	11	11	00	00	00	00	00	00
11	11	11	01	00	00	00	00	00
11	11	11	10	00	00	00	00	00
11	11	11	11	00	00	00	00	00

1111
1000
10001
1001

5

b. Draw the internal structure of the ROM showing only the last 5 memory lines (words).



Question [5]: [12 mark]

a) Derive the next state (characteristic) equation for T- Flip-Flop.

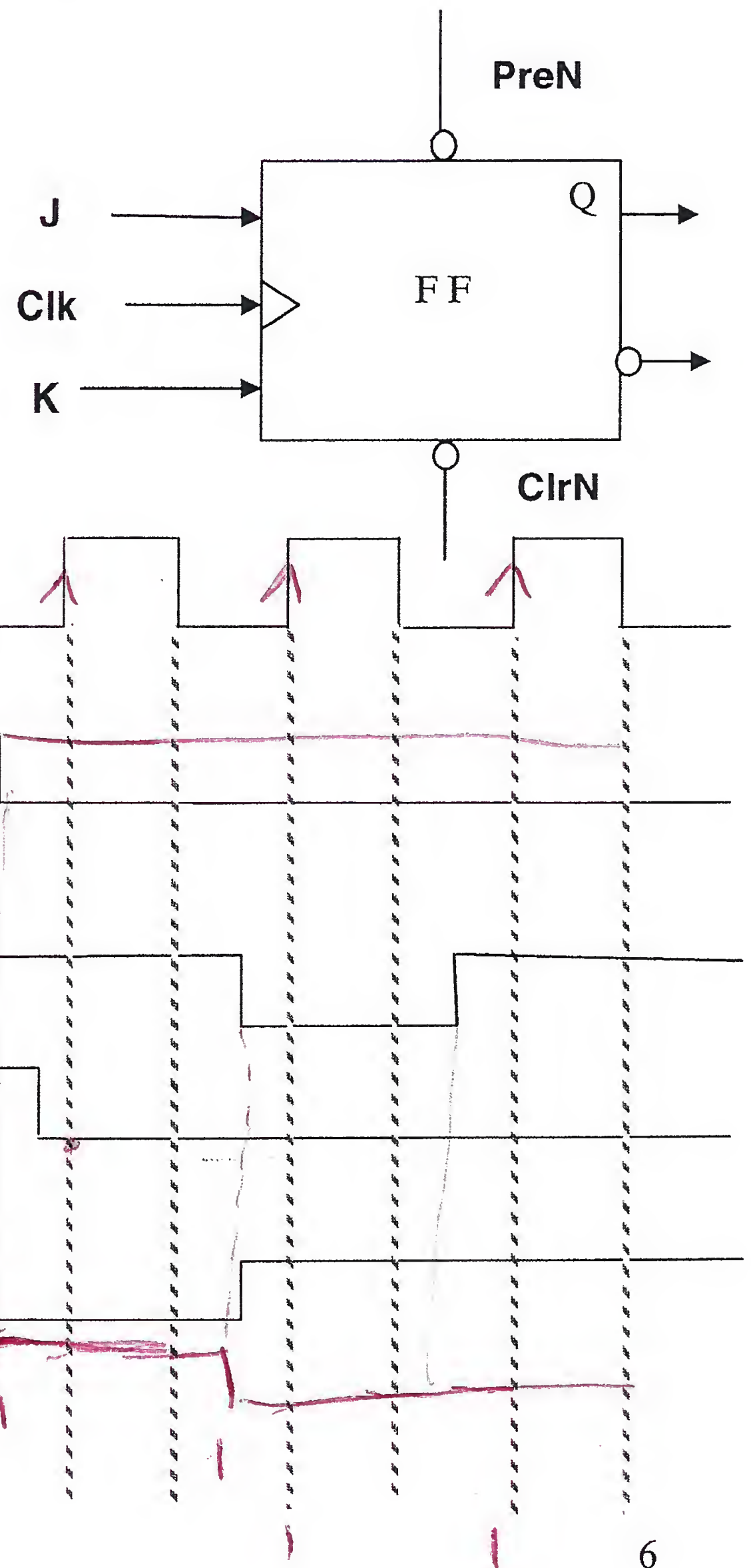
T	Q	Q ⁺
0	0	0
0	1	1
1	0	1
1	1	0

$$Q^+ = T \oplus Q$$

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b) Complete the following timing diagram for the following J-K Flip Flop.



J	K	Q
0	0	no change
0	1	0
1	0	1
1	1	Q

(8)